



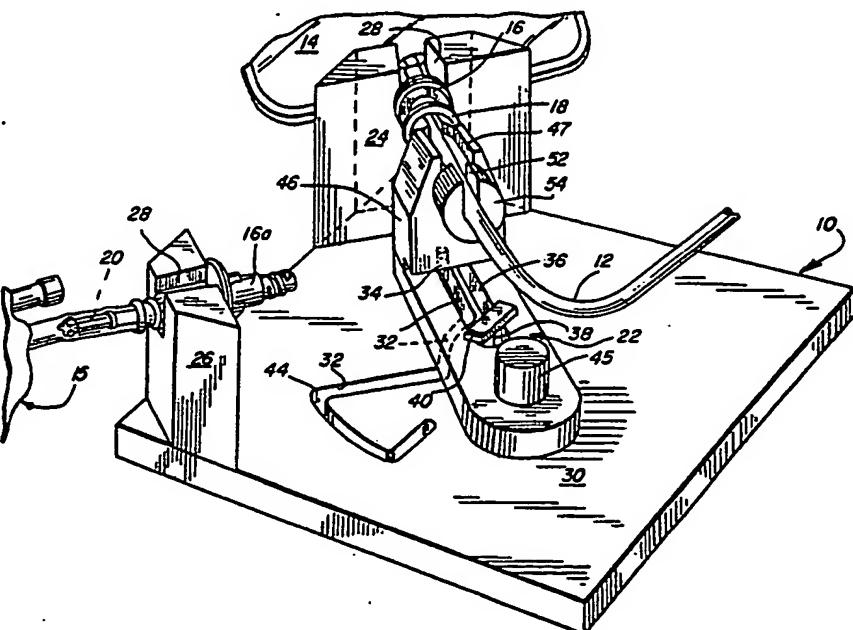
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(54) Title: AUTOMATIC CONNECTION DEVICE

(57) Abstract

Apparatus for removing a first connector (18) from a second connector (16) and a reconnecting the first connector (18) with a third connector (16a) by mechanical means so that the visually impaired can do it, without touching critical areas where sterility should be retained. The apparatus finds particular use in the field of peritoneal dialysis where the catheter or set (12) connected to the patient must be disconnected from one container of solution (14) and reconnected to another container (15) under the most aseptic conditions possible. A platform (30) is provided having first slot means (32) for permitting controlled movement of a first retention means (22) between a first position (Figure 1), permitting disconnection between the first and second connectors (18, 16), and a second position (Figure 2), permitting connection between the



first and the third connectors (18, 16a) when the first, second and third connectors (18, 16, 16a) are respectively carried in the first, second and third retention means (22, 24, 26). A first pin means (34) is carried on the first retention means (22) and is slideable in the first slot means (32). A second slot means (36) is defined in the first retention means (22) and a second pin member (38) is carried on the platform (30) so as to be slideable in the second slot means (36).

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AUTOMATIC CONNECTION DEVICE

In peritoneal dialysis and particularly continuous ambulatory peritoneal dialysis (CAPD) there is a great need to maintain aseptic conditions during the course of the procedure, during which peritoneal dialysis solution is passed into the peritoneal cavity and thereafter removed from the peritoneal cavity. Typical peritoneal dialysis procedures require disconnection and reconnection of a connector which terminates a set communicating with the interior of the peritoneal catheter with other connectors on various bags or other containers of peritoneal dialysis solution. The slightest touch of a critical portion of the connector with a contaminated surface is believed to create a significant risk of peritonitis to the patient.

The problem of contamination of a connector while bags of peritoneal dialysis solution are being changed is particularly serious in the case of visually impaired patients or other patients who exhibit tremors in their hands, and the like. Many such patients have end stage renal disease, and require dialysis in order to maintain life. There is therefore a need to provide such patients, and other patients as well, with a reliable technique to provide a controlled means for disconnecting and reconnecting the various connectors in a manner which will minimize the risk of contamination, providing a reliable mechanical means to assure such contamination-free connection.

One mechanical device for accomplishing this is the Steri-Track device which has been used and which is described in an article entitled "CAPD for the Blind" from the Periodical Nephrology Nurse, March/April 1981, pp.



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53-54. This device is a self-contained, portable device. When doing solution bag changes, a fresh bag of dialysis solution is placed into a stationary end of a holder. The protective tab of the bag is removed, and a spike is taken from the discharge bag and fitted into the grooves of a movable plate. The patient now manipulates the sliding plate toward the bag, with the result that the spike will plunge into the port of the bag with alleged 98 percent probability.

This, however, solves only a portion of the problem since contamination can be picked up between the time the spike is removed from the bag and inserted into the fresh bag. For example, the patient may cause the spike to brush against a contaminated surface while trying to load it into the device.

In Munsch, et al U.S. Application Serial No. 416,785, filed September 10, 1982, and entitled "Automatic Connection and Disconnection" an apparatus is provided in which a connection in a peritoneal dialysis system can be loaded into the device without breaking of the connection. Thereafter, the breaking of the connection and the making of the new connection can be done in a positive, mechanical manner, while the patient can keep his hands entirely away from all the connectors, so that the chance of accidental contamination even by a blind patient is greatly reduced. The apparatus shown uses a pair of shaped slots into which a movable retention means for a connector fits, to permit its motion between a first and a second position with the connection of a connector carried therein being made with a second connector in the first position and a third connector in the second position.

In accordance with this invention, improvements are provided to such a device wherein the device is



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simplified, and also made capable of easy disassembly for cleaning and the like. Furthermore, the device of this invention can be used for the precise, mechanical connection of connectors which fit together in screw-threaded or other rotary locking relationship.

DESCRIPTION OF THE INVENTION

This invention relates to apparatus for removing a first connector from a second connector and reconnecting the first connector with a third connector, which comprises first, second and third retention means for respectively carrying first, second and third connectors. Platform means are provided for carrying the first, second and third retention means in typically fixed spatial relationship with each other.

First slot means are provided to the platform means for permitting controlled movement of the first retention means along with the first slot means between a first position permitting disconnection between first and second connectors, and a second position permitting connection between first and third connectors, when the first, second and third connectors are respectively carried in the first, second and third retention means.

In accordance with this invention, a first pin member is carried by the first retention means and is slidable in the slot means. A second slot is defined in the first retention means, and a second stationary pin member is carried by the platform means in a position to be slidable in the second slot. Thus, the first retention means moves along a fixed positional path from the first position to the second position and back again, for the precise conveyance of the first connector from an engaging position with the second connector to an engaging position



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with the third connector, in a manner which can easily be done by a visually impaired person or another person suffering a disability in manual dexterity, with greatly reduced risk that the connectors will be contaminated during the process.

Typically, the first retention means carries rotatable barrel means defining an aperture for receiving a first connector. The purpose of this is to permit rotational connection and disconnection between the first connector and other connectors, specifically the second and third connectors.

The barrel means may define an axis of rotation parallel to the axis of the second slot of the first retention means which, in turn, is typically parallel to the axis of the first retention means itself.

It is also desirable for the aperture of the barrel means to be proportioned and adapted to prevent relative rotation of a connector carried in it with the barrel itself, so that the barrel means can be rotated with positive rotational control of the connector. Typically this may be accomplished by making the connector-gripping portion of the aperture of noncircular cross section and of a shape to grip the specific periphery of the desired connector, to prevent rotation. Additionally, the aperture of the barrel may constitute a bore extending the length thereof, plus a longitudinal slot which communicates between the bore and the exterior, so that the connector may be inserted laterally into the barrel means, and any tubing to which the connector is attached may also be inserted therein through the slot.

It is further desirable for the second stationary pin member carried on the platform means to define an elongated head overlying the second slot of the first retention means, to lock the first retention means onto



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the platform means. However, the elongated head may be proportioned to permit removal of the first retention means from the platform means when the head is in a position parallel to the second slot. Thus the first retention means may be removable from the platform means, with the elongated head passing through the second slot for separation of the components. Thus, the individual components of the platform means and first retention means can be separately cleaned between uses and easily reassembled.

To facilitate the above, the first slot means may define a hooked section spaced from sections of the first slot which permit the movement between the first and second positions discussed above. The hooked section permits movement of the first retention means into the position of parallel relation with the elongated head, permitting separation of the components.

The first slot means also may define a pair of angularly related straight sections, connected by an arcuate section, to permit movement of the first retention means between the first and second positions.

DESCRIPTION OF DRAWINGS

Referring to the drawings, Figure 1 is a perspective view of one embodiment of the apparatus of this invention with the first retention means being shown in its first position.

Figure 2 is a perspective view of the apparatus of Figure 1 with the first retention means shown in a position intermediate between the first and second positions, with a portion of the set held therein broken away.

Figure 3 is a plan view of the apparatus of Figure 1



showing the first retention means in a position advanced from that of Figure 2 toward its second sliding position, with the first sliding position being shown in phantom.

Figure 4 is a plan view of the apparatus of the previous drawings showing its mode of disassembly.

Figure 5 is a sectional view taken along line 5-5 of Figure 3.

Figure 6 is a sectional view taken along line 6-6 of Figure 3.

Figure 7 is a sectional view taken along line 7-7 of Figure 3.

DESCRIPTION OF SPECIFIC EMBODIMENT

Referring to the drawings, apparatus 10 of this invention is for providing reliable mechanical means for removing a connection between a conventional CAPD set 12, for example, which connects to a peritoneal catheter of a patient at one end, and a first dialysis solution bag 14, and for providing reliable mechanical connection between set 12 and a second peritoneal dialysis solution bag 15. The specific design of connectors utilized in the bags and sets for connection and disconnection may be in accordance with U.S. Patent No. 4,294,250, for example. Bag 15 may be sealed with a break-away member 20 for access to the contents of the bag in accordance with U.S. Patent No. 4,340,049, for example.

As shown, the apparatus comprises a first retention means 22, typically for holding connector 18 of set 12. Second and third retention members 24, 26 define slots 28, each of which are proportioned to hold a connector 16, 16a of one of the dialysis solution bags 14, 15. Slots 28 may be of trapezoidal shape in plan view (figs. 3 and 4), so that narrow rear ends 29 of slots 28 can grip the



connector held therein, cooperating with ring 31 of a connector (fig. 1) to limit its advancement in slot 28.

Each of retention means 22, 24, 26 are carried on platform 30, which may be a plastic plate or the like.

Platform 30, in turn, defines a first slot 32 of the shape indicated in Figure 4, for permitting controlled movement of first retention means 22 along first slot 32 between a first position permitting disconnection between first and second connectors 16, 18, as shown in Figure 1, and a second position permitting connection between first and third connectors 18, 16a, resulting from advancement of first retention means 22 to a position where the two connectors can be locked together i.e. approximately that shown in Figure 3.

Pin member 34 is carried by first retention means 22 and projects in sliding relationship into slot 32, which can extend completely through platform 30 for ease of cleaning. Thus the position of the front end of first retention means 22 is controlled by the position of pin member 34 in slot 32.

First retention means 22 also defines a second slot 36, typically a straight slot, into which projects stationary pin 38, immovably affixed to platform means 30. Stationary pin 38 carries an elongated head 40 which, in most positions of member 22 in slot 32, retains member 22 in sliding, retained relationship with platform 30. Accordingly, first retention means 22 is retained on platform 30 due to its double retention at two positions, one by the action of pin 38 in slot 36, and the other by the action of pin 34 in slot 32. This permits first retention member 22 to be precisely aligned in its first position as shown in Figure 1, so that connectors 16, 18 can be disconnected or connected together in that position.



First retention means 22 can then slide along the precisely defined continuum of positions to the second position in which connector 18 can lock with connector 16a, with pin 34 moving from one end 42 of slot 32 (Figure 3) almost to intermediate corner 44 of slot 32, at which time the second position is achieved. During this path of motion, first retention means 22 is held in pivoting relationship with pin 38 in slot 36 for precise, angular guidance of member 22 as its pin 34 slides along slot 32, being retained in locked relation with platform 30 by elongated head 40.

Accordingly, even a blind person can simply grasp handle 45 of member 22, to reliably move a connector 18 carried therein between the first and second positions, for unlocking connector 18 from connector 16 and then relocking connector 18 with another connector 16a.

First retention means 22 carries a block 46 defining a slot in which rotatable barrel means 48 is carried. Barrel means 48, in turn, defines an aperture 50, plus an added slot 52 extending its entire length, for receiving and retaining a connector 18 as well as the length of set tubing 12 to which the connector is attached. Set 12 may be placed into the rotating barrel means while connector 18 is carried within aperture 50. See Figure 7, for example.

As shown, aperture 50 may be proportioned to prevent relative rotation of a connector 18 held therein by being, for example, of square or rectangular cross-section, so that rotation of barrel member 48 can cause rotation of the connector. This permits locking of the screw threaded connectors together with ease, simply by grasping handle 54 and rotating while engaging the respective connector 16 (for unlocking) or 16a (for locking). Barrel member 48 may be held in snapfit relation in the slot 47 of post 46,



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and may have an axis of rotation parallel to the axis of slot 36.

Bolts 53 hold post 46 onto member 22, while bolts 55 may retain each of second and third retention means 24, 26 onto platform member 30.

As shown particularly in Figure 4, slot 32 may comprise a pair of angularly related straight sections 56, 58, connected by an arcuate section 60 to permit movement of the first retention means 22 between the first and second positions.

Additionally, slot 32 defines a hooked section 62 which is spaced from sections of slot 32 which permit movement between the first and second positions. This hooked section 62 may be present to permit movement of first retention means 22 into a position where second slot 36 is essentially parallel to the long axis of elongated head 40. Elongated head 40 may then be proportioned so that member 22 may be lifted off in that position, as shown in Figure 4, for cleaning and the like, with pin 34 simply lifting out of slot 32 in that position.

After cleaning, member 22 may be replaced, with head 40 of pin 38 passing through slot 36, and pin 34 passing into hooked section 62 of slot 32. Thereafter, member 22 may be moved again so that pin 34 passes into sections 56, 58 and 60 of slot 32, in which position head 40 is in angular relation to slot 36, thus locking first retention means 22 onto platform member 30.

Accordingly, in use, a CAPD patient who is blind or physically debilitated may have a transfer set 12 connected to his peritoneal catheter, terminating in a connector 18, which, in turn, is connected to a connector 16 of an empty bag 14.

The patient has the peritoneal dialysis solution in his peritoneal cavity, and he seeks to make an exchange.



He simply places the connected bag and connectors into the device of this invention as shown in Figure 1, which is the desired first position. He then places a fresh bag 15 of peritoneal dialysis solution into third retention means 26 as shown, removing the protective cover of connector 16a. The patient then rotates handle 54 to disconnect the threaded connection between connectors 16 and 18. He does not touch either of connectors 16 or 18. The patient then grasps handle 45, and pulls first retention means 22 to cause pin 34 to slide along slot 32, pivoting through arcuate section 60, with an intermediate stage shown in Figure 2, until pin 34 reaches approximately angle 44 of slot 32. At this point, connector 18 is in engagement with connector 16a. The patient then rotates handle 54 again, touching nothing else except perhaps handle 45, to cause the two connectors to enter into tight, screw-threaded relationship. The connection process is thus completed, with the patient touching only handles 45 and 54 as the disconnection and reconnection is made.

Thereafter, an outer protector may be applied to the joined connectors 16a, 18 of the type shown in U.S. Patent No.4,340,052, to further protect the connection.

The above has been offered for illustrative purposes only, and is not intended to limit the scope of this present invention, which is as defined in the claims below.



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THAT WHICH IS CLAIMED IS:

1. In apparatus for removing a first connector from a second connector and reconnecting the first connector with a third connector, which comprises: first, second, and third retention means for respectively carrying first, second, and third connectors; platform means for carrying said first, second, and third retention means; and first slot means on said platform means for permitting controlled movement of said first retention means along said first slot means between a first position permitting disconnection between first and second connectors and a second position permitting connection between first and third connectors, when said first, second, and third connectors are respectively carried in the first, second, and third retention means, the improvement comprising, in combination:

a first pin member carried by the first retention means and slideable in said first slot means, a second slot defined in said first retention means, and a second, stationary pin member carried on said platform means and slideable in said second slot.

2. The apparatus of claim 1 in which said first retention means carries rotatable barrel means defining an aperture for receiving said first connector to permit rotational connection and disconnection between said first connector and other connectors.

3. The apparatus of claim 2 in which said barrel means defines an axis of rotation parallel to the axis of said second slot.

4. The apparatus of Claim 2 in which the aperture of said rotatable barrel means is proportioned to prevent relative rotation of a connector held therein with respect



to said barrel means, whereby rotation of said barrel means can cause rotation of said connector.

5. The apparatus of claim 1 in which said second, stationary pin member defines an elongated head overlying said second slot and permitting removal of said first retention means from the platform means when said head is parallel to said second slot.

6. The apparatus of claim 5 in which said first slot means defines a hooked section spaced from sections of the first slot which permit said movement between the first and second positions, said hooked section permitting movement of the first retention means into position permitting said removal.

7. The apparatus of claim 1 in which said first slot means defines a pair of angularly related straight sections connected by an arcuate section to permit movement of the first retention means between said first and second positions.

8. In apparatus for removing a first connector from a second connector and reconnecting a first connector with the third connector, which comprises first, second and third retention means for respectively carrying said first, second and third connectors; platform means for carrying said first, second and third retention means; first slot means on said platform means for permitting controlled movement of said first retention means along said first slot means between the first position permitting disconnection between first and third connectors, and a second position permitting connection between first and third connectors, when said first, second and third connectors are respectively carried in the first, second and third retention means, the improvement comprising, in combination:

A first pin member carried by the first retention



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means and slideable in said slot means, a second slot defined in said first retention means, and a second stationary pin member carried on said platform means and slideable in said second slot, said first retention means carrying rotatable barrel means defining an aperture for receiving said first connector to permit rotational connection and disconnection between said first connector and other connectors, said second stationary pin member defining an elongated head overlying said second slot and permitting removal of said first retention means from the platform means when said head is parallel to the second slot.

9. The apparatus of Claim 8 in which said first slot means defines a hooked section spaced from sections of the first slot which permit said movement between the first and second positions, said hooked section permitting movement of the first retention means into position permitting said removal.

10. The apparatus of Claim 9 in which said first slot means defines a pair of angularly related straight sections connected by an arcuate section to permit movement of the first retention means between said first and second positions.

11. The apparatus of Claim 10 in which said barrel means defines an axis of rotation parallel to the axis of said second slot.

12. The apparatus of Claim 11 in which the aperture of said rotatable barrel means is proportioned to prevent relative rotation of a connector held therein with respect to said barrel means, whereby rotation of said barrel means can cause rotation of said connection.

13. An apparatus for removing a first connector from a second connector and reconnecting the first connector with a third connector, which comprises: first, second and



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third retention means for respectively carrying said first, second and third connectors; platform means carrying said first, second and third retention means; first slot means on said platform means permitting controlled movement of said first retention means along said first slot means between a first position permitting disconnection between first and second connectors and the second position permitting connection between first and third connectors, when said first, second and third connectors are respectively carried in the first, second and third retention means, the improvement comprising, in combination, rotatable barrel means carried by said first retention means and defining an aperture for receiving said first connector, to permit rotational connection and disconnection between said first connector and other connectors, said aperture defining a noncircular configuration to receive said first connector in fixed, nonrotatable relation relative to said barrel means, whereby said barrel means can firmly rotate said connector for positive rotational connection and disconnection.

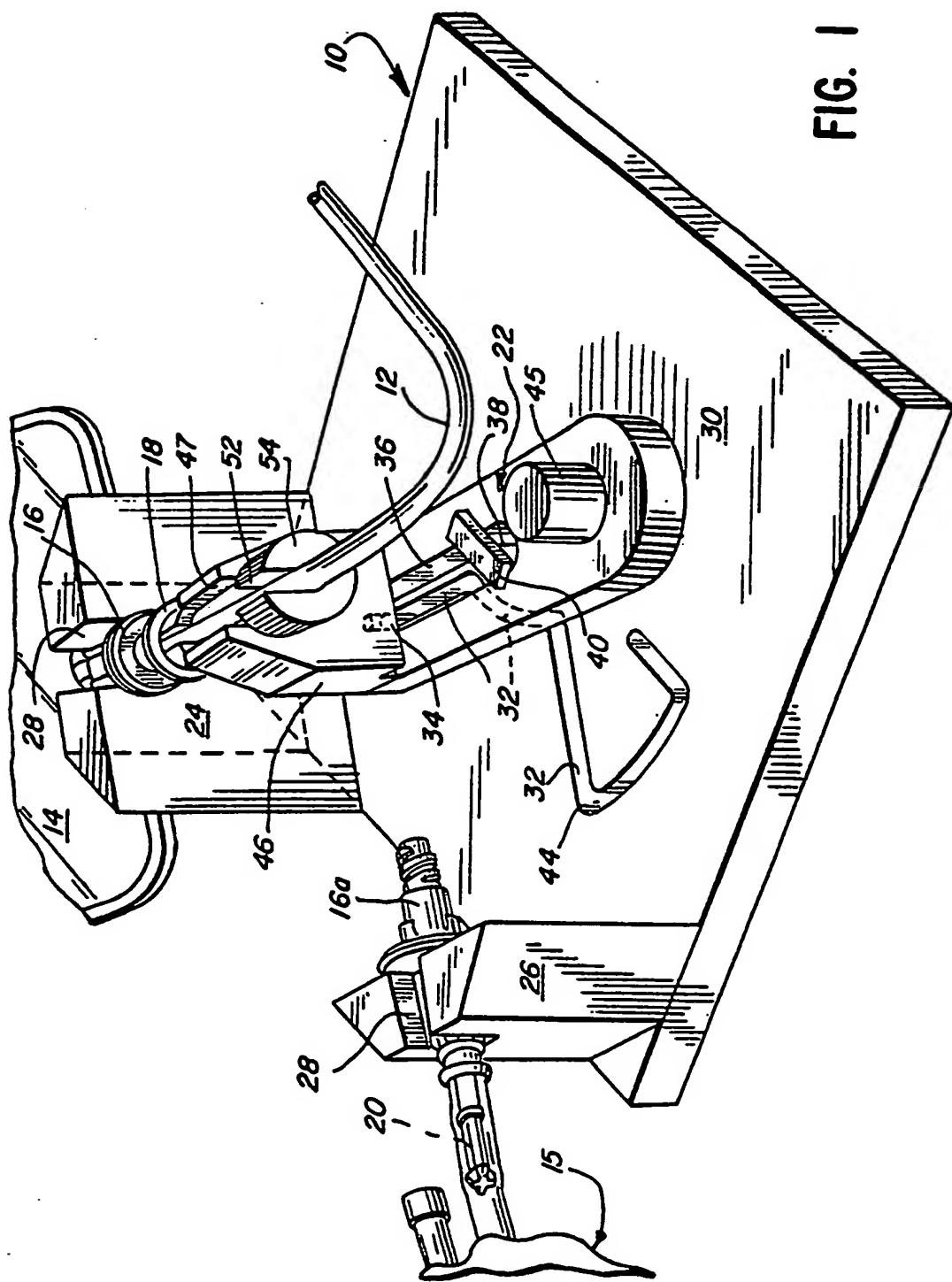
14. The apparatus of Claim 13 in which said aperture includes a bore extending the length of said barrel means, and a longitudinal slot providing communication between the bore and the exterior, whereby said first connectors and tubes which they carry may be inserted into said barrel means through said longitudinal slot.

15. The apparatus of Claim 14 in which said barrel means defines an axis of rotation parallel to the axis of said first retention means.



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FIG. 1



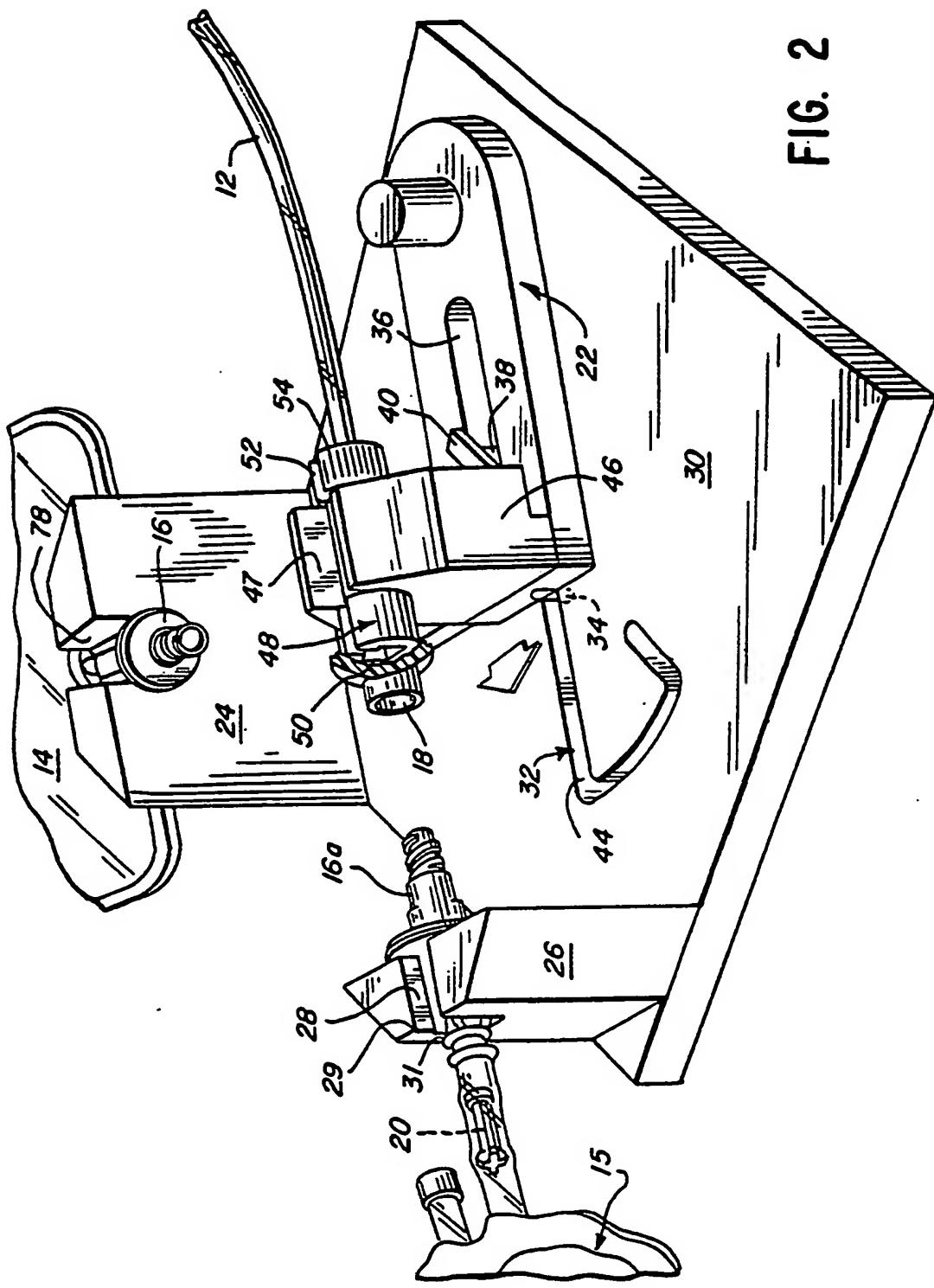


FIG 2

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FIG. 3

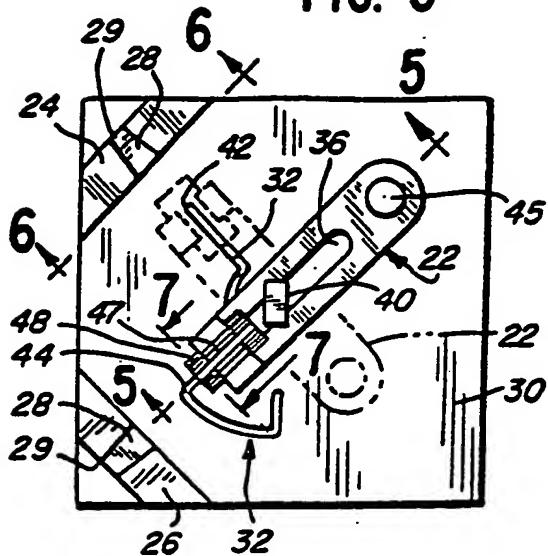


FIG. 4

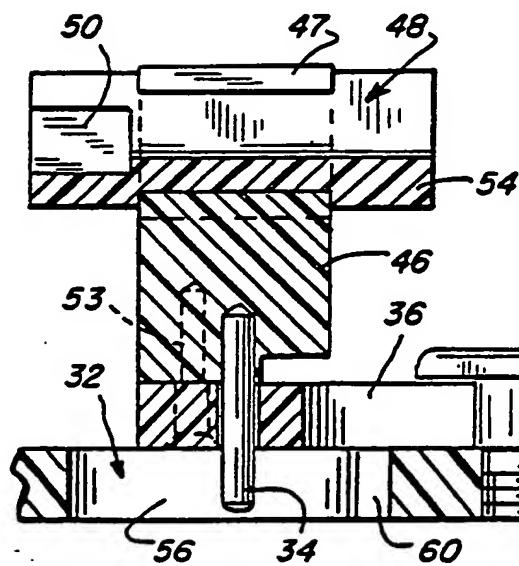
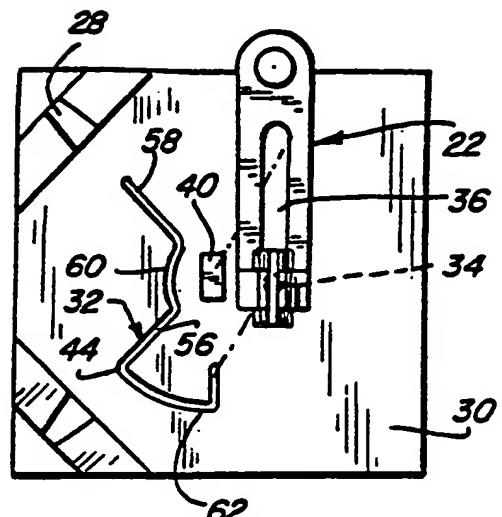


FIG. 5

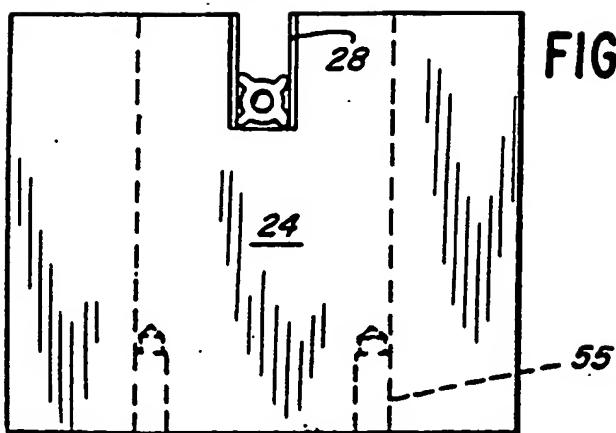


FIG. 6

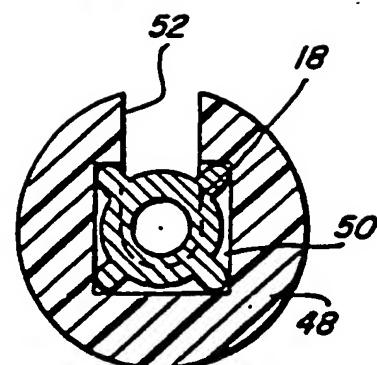


FIG. 7

INTERNATIONAL SEARCH REPORT

International Application No PCT/US83/01909

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all):³

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC: A61M 5/14; A61J 5/00 US: 222/83; 141/330; 248/74.1

II. FIELDS SEARCHED

Minimum Documentation Searched⁴

Classification System	Classification Symbols
US	604/27-30, 33, 34, 62, 80, 81, 188, 246, 249, 257, 261, 262, 406-408, 604/410-413, 905; 222/83, 83.5, 89, 129, 145; 285/12; 53/469; 248/74.1, 74.5, 95;

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched⁵

II. (cont'd) 141/248, 330; 137/318, 635

III. DOCUMENTS CONSIDERED TO BE RELEVANT¹⁴

Category ⁶	Citation of Document, ¹⁵ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
Y, A	US, A, 1,709,898	23 April 1929 (CUNNEEN) (1, 5-7) (8-10)
A	US, A, 2,979,554	11 April 1961 (MAITLAND) (2-4, 8, 11-15)
Y, A	US, A, 3,413,097	26 November 1968 (JUNGNER) (1, 5-7) (8-10, 13)
A	US, A, 3,840,011	08 October 1974 (WRIGHT)
Y, A	US, A, 4,141,524	27 February 1979 CORVESE, JR.) (1, 5-7) (8-10)
A	US, A, 4,219,055	26 August 1980 (WRIGHT)
A	US, A, 4,267,994	19 May 1981 (LYNCH et al) (2-4, 8, 11-15)
A	US, A, 4,339,213	13 July 1982 (GILMORE) (2-4, 8, 11-15)

* Special categories of cited documents:¹⁵

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"Z" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search¹⁶

01 February 1984

International Searching Authority¹⁷

ISA/US

Date of Mailing of this International Search Report¹⁸

06 MAR 1984

Signature of Authorized Officer¹⁹

Fred Rosenbaum
FRED ROSENBAUM
S.P.E.

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

P,Y,A	US, A, 4,405,315	20 September 1983 (HANDT)	(1, 5-7) (8-10, 13)
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V. OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹⁰

This International search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. Claim numbers _____, because they relate to subject matter ¹² not required to be searched by this Authority, namely:

2. Claim numbers _____, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out ¹³, specifically:

VI. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ¹⁴

This International Searching Authority found multiple inventions in this international application as follows:

1. As all required additional search fees were timely paid by the applicant, this International search report covers all searchable claims of the International application.
2. As only some of the required additional search fees were timely paid by the applicant, this International search report covers only those claims of the International application for which fees were paid, specifically claims:
3. No required additional search fees were timely paid by the applicant. Consequently, this International search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:
4. As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

- The additional search fees were accompanied by applicant's protest.
- No protest accompanied the payment of additional search fees.